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Four *Pyrenula* species new to China

Jie-Meng Fu [1A#], André Aptroot [3B#],
Zhong-Liang Wang [1], Lu-Lu Zhang [2C*]

[1] *Key Laboratory of Plant Stress Research, College of Life Sciences &*
[2] *Institute of Environment and Ecology,*
Shandong Normal University, Jinan, 250014, P. R. China
[3] *ABL Herbarium, Gerrit van der Veenstraat 107, NL-3762 XK Soest, The Netherlands*

[*] Correspondence to: [A] *jiemengfu11@outlook.com,* [B] *andreaptroot@gmail.com,*
[C] *675359138@qq.com*

Abstract—*Pyrenula brunnea*, *P. punctella, P. subducta,* and *P. submastophora* are reported for the first time from China. This increases the number of *Pyrenula* species known from China to 46. Descriptions and distribution of the four species are given.

Key words—Asia, lichen-forming fungi, *Pyrenulaceae*, taxonomy

Introduction

Pyrenula Ach. (*Pyrenulaceae*, *Eurotiomycetes*) comprises crustose lichens typically growing on smooth, shaded bark (Aptroot 2012) in the tropics and subtropics (Mendonça & al. 2016). It is characterized by a corticate (occasionally ecorticate) UV± yellow thallus with or without pseudocyphellae and with perithecioid ascomata, an occasionally inspersed hamathecium with unbranched filaments, and distoseptate, bacillar or (sub)muriform ascospores that are brown when mature with rounded, diamond-shaped, or elongated lumina and with or without orange oil when over-mature.

In his world key to *Pyrenula* species, Aptroot (2012) accepted 169 species out of the c. 745 named taxa in the genus. With many new species of *Pyrenula*

[#] Jie-Meng Fu & André Aptrootcontributed equally to this research.

since described, the genus currently comprises c. 226 species worldwide (Ingle & al. 2018), of which 42 are known from China (Wei 1991, Aptroot 2003, Aptroot & Seaward 1999, Aptroot & Sipman 2001, Fu & al. 2018, Seaward & Aptroot 2005, Wang & al. 2018).

The purpose of this paper is to contribute to the knowledge of *Pyrenula* in China and to provide data for the Lichen Flora of China (in prep.). Here we report four species from China for the first time—*Pyrenula brunnea*, *P. punctella*, *P. subducta,* and *P. submastophora*—increasing the number of species known from China to 46.

The specimens studied are from Guizhou province, located in southern China on the Yunnan–Guizhou plateau (24°37′–29°13′N 103°36′–109°35′E). The landscape belongs to the plateau mountain region, with an average elevation of about 1100 m. Guizhou has a subtropical humid monsoon climate (rainy and hot at the same time) with the average temperature usually 22–25°C during the warmest month (July); the annual precipitation averages 1200 mm (rain mostly occurring during June–September).

Materials & methods

The specimens studied are preserved in the Lichen Section of the Herbarium, College of Life Sciences, Shandong Normal University, Jinan, China (SDNU). Their morphology was examined under a COIC XTL7045B2 stereo-microscope and Olympus CX41compound microscope. Unless otherwise indicated, sections were mounted and measured in tap water or enhanced with KOH. The lichen substances were studied by standardized thin layer chromatography (TLC) using solvent system C (Orange & al. 2010). Photos were taken with Olympus SZX16 and BX61 with DP72.

Taxonomy

Pyrenula brunnea Fée, Essai Crypt. Écorc. 2: 81 (1837) Fig. 1a–d

Morphology—Thallus corticate, brownish, without pseudocyphellae, UV–. Perithecia simple, solitary, often partly covered by the thallus, 0.4–0.5 mm diam. Ostioles black, apical. Perithecial wall ≤150 µm thick. Hamathecium not inspersed with oil droplets. Ascospores 8/ascus, pale brown, 3-septate, with rounded ends, 12.5–15 × 7.5 µm, lumina in a straight line, somewhat rounded, end lumina with a thick apical endospore layer, over-mature ascospores shriveled, without red-orange oil.

Chemistry—No chemical substances detected by TLC.

Specimen examined: **China**. **Guizhou**, **Tongren**, Jiangkou, Mt. Fanjing, alt. 1300 m, on bark, 1 Nov. 2009, Zhao-Jie Ren 20101318 (SDNU).

Distribution—Pantropical (Aptroot 2012). New to China.

Comments—*Pyrenula brunnea* is similar to *P. aspistea* (Ach.) Ach., which has narrower ascospores (4–6 µm; Aptroot 2012). Our material fits the description of *P. brunnea* specimens from northeast India quite well (Upreti 1991).

Pyrenula punctella (Nyl.) Trevis., Conspect. Verruc.: 13 (1860) Fig. 1e–h

Morphology —Thallus corticate, yellowish, with white pseudocyphellae, UV–. Perithecia solitary, aggregated only by chance when crowded, 0.3–0.4 mm diam. Ostioles pale, apical. Perithecial wall ≤140 µm thick. Hamathecium not inspersed with oil droplets. Ascospores 8/ascus, brown, 3-septate, fusiform with pointed ends, 37.5–40 × 12.5–15 µm, lumina angular to usually somewhat rounded, end lumina with a thick apical endospore layer, overmature spores lacking orange oil.

Chemistry —No chemical substances detected by TLC.

Specimen examined: **CHINA**. **Guizhou**, **Libo**, Maolan protection zone, alt. 500 m, on bark, 2 Nov. 2009, Hai-Ying Wang 20102422 (SDNU).

Distribution—Temperate America, extending to Japan (Aptroot 2012). New to China.

Comments—*Pyrenula punctella* is similar to *P. mastophora* (Nyl.) Müll. Arg., which differs by lacking pseudocyphellae and having central lumina that are much wider than long (Aptroot 2012). Our material closely fits the protologue description of the *P.* (≡ *Verrucaria*) *punctella* holotype specimen (Nylander 1858).

Pyrenula subducta (Nyl.) Müll. Arg., Flora 67: 666 (1884) Fig. 1i–l

Morphology—Thallus corticate, yellowish brown, UV–. Perithecia simple, only aggregated by chance when crowded, often largely covered by thallus, 0.4–0.6 mm diam. Ostioles brown, apical. Perithecial wall ≤150 µm thick. Hamathecium not inspersed with oil droplets. Ascospores 8/ascus, uniseriate, brown, 3-septate, with rounded or pointed ends, 40–42.5(–45) × 15–17.5 µm, lumina in a straight line and somewhat rounded, end lumina with an apical endospore layer, over-mature ascospores without orange oil.

Chemistry—No chemical substances detected by TLC.

Specimens examined: **CHINA**. **Guizhou**, **Tongren**, Jiangkou, Mt. Fanjing, alt. 2300 m, on bark, 29 Mar. 2011, Xing-Ran Kou 20111283 (SDNU), Yu-Liang Chen 20111082 (SDNU). **Libo**, Maolan protection zone, alt. 500 m, on bark, 2 Nov. 2009, Yu-Liang Chen 20102362 (SDNU), Hai-Ying Wang 20102367 & 20102425 (SDNU); alt. 350 m, on bark, 2 Nov. 2009, Dai-Feng Jiang 20102432 (SDNU).

Distribution—Neotropical (Aptroot 2012). New to China.

Comments—*Pyrenula subducta* is similar to *P. caryae* R.C. Harris, which differs by the presence of black granules at the ascospore tips (Aptroot 2012). Our material fits the description of India collections of *P. subducta* quite well, but the Indian material has a brown to reddish-brown thallus (Ingle & al. 2018).

Pyrenula submastophora Ajay Singh & Upreti,
Geophytology 17(1): 85 (1987) Fig. 1M–P

Morphology—Thallus corticate, brownish, without pseudocyphellae, UV–. Perithecia simple, subglobose, erumpent, 0.4–0.6 mm diam. Ostioles black, apical. Perithecial wall ≤160 µm thick. Hamathecium not inspersed with oil droplets, filaments unbranched. Ascospores 8/ascus, uniserial, grey-brown, 3-septate, fusiform with rounded ends, 21–23 × 7.5 µm, end lumina with a thick apical endospore layer. Over-mature spores lacking orange oil.

Chemistry—No chemical substances detected by TLC.

Specimen examined: **China**. **Guizhou**, **Libo**, Maolan protection zone, alt. 500 m, on bark, 2 Nov. 2009, Hai-Ying Wang 20102312 (SDNU).

Distribution—Eastern palaeotropical India (Aptroot 2012). New to China.

Comments—*Pyrenula submastophora* is similar to *P. acutispora* Kalb & Hafellner, which differs by its ascospores having at least one pointed end (Aptroot 2012). Our specimen fits the description of Indian collections of *P. submastophora* (including the holotype), but the Indian material has larger perithecia (0.8–1.2 mm diam.; Upreti 1992).

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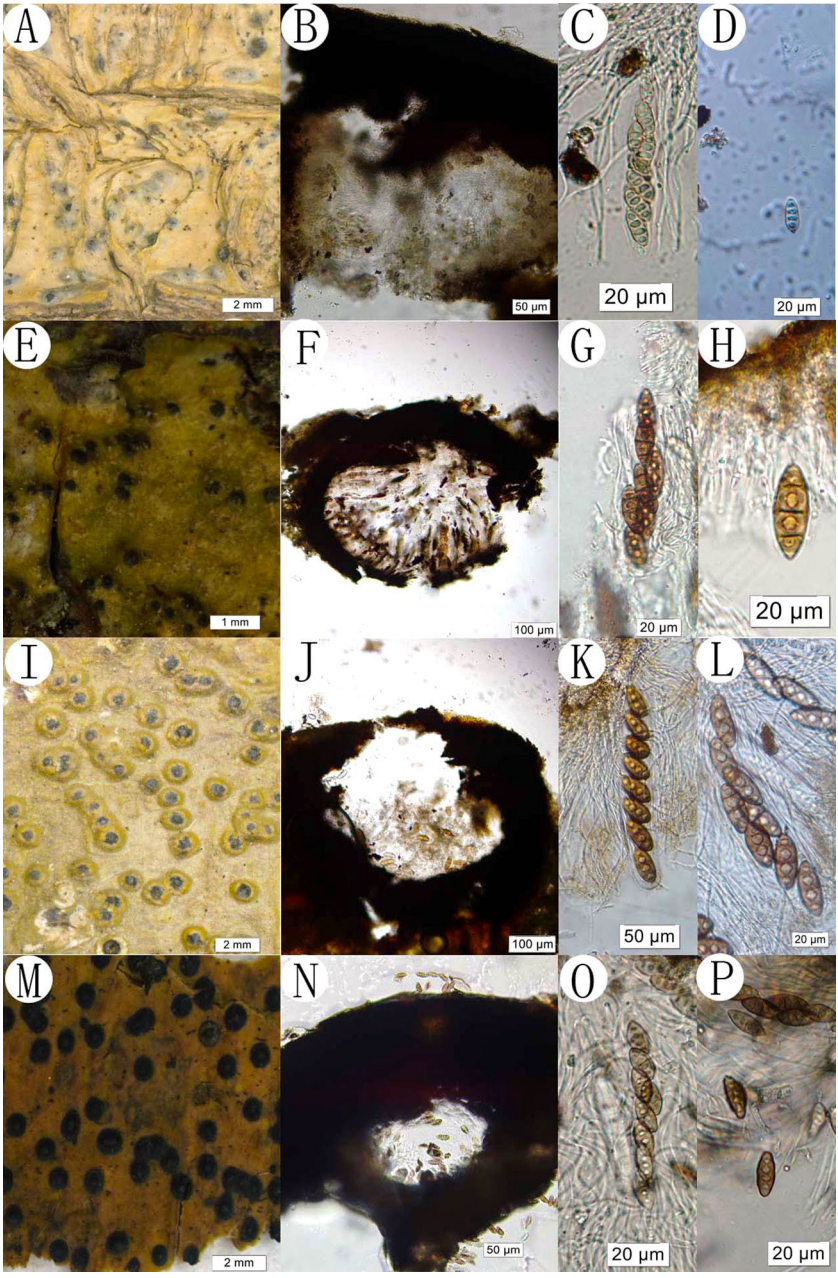
Fig. 1. ***Pyrenula brunnea*** (Ren 20101318, SDNU). A. thallus with ascomata; B. transverse section through ascoma; C. ascus; D. ascospores. ***Pyrenula punctella*** (Wang 20102422, SDNU). E. thallus with ascomata; F: transverse section through ascoma. G: ascus. H: ascospores. ***Pyrenula subducta*** (Kou 20111283, SDNU). I. thallus with ascomata; J. transverse section through ascoma; K. ascus with 8 ascospores; L. ascospores. ***Pyrenula submastophora*** (Wang 20102312, SDNU). M. thallus with ascomata; N. transverse section through ascoma; O. ascus with 8 ascospores; P. ascospores. Scale bars: E = 1 mm; A, I, M = 2 mm; C, D, G, H, L, O, P = 20 µm; B, K, N = 50 µm; F, J = 100 µm.


A
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50 μm
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M
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N
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O
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